



Draft Vegetation Management Plan

Regrowth - Kurri Kurri – Precinct 1

Loxford Project Management Pty Ltd

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Contents

1. Introduction	1
1.1 Purpose of this report	1
1.2 Scope and limitations	1
1.3 Terms and definitions	2
1.4 Links to legislation, other plans and documents	2
1.5 Objectives	2
1.6 Timing	3
1.7 Roles and responsibilities	3
2. Existing environment	6
2.1 Location	6
2.2 Existing land use	6
2.3 Existing vegetation	6
2.4 Threatened ecological communities	6
2.5 Threatened flora	7
2.6 Exotic flora	7
2.7 Fauna habitats	8
2.8 Environmental constraints	8
3. Management zones	9
4. Management actions	15
4.1 Restoration targets	15
4.2 General site procedures	17
4.3 Weed control	19
4.4 Top Soil Preparation	19
4.5 Revegetation guidelines	20
4.5.1 Direct seeding	20
4.5.2 Hand Broadcasting of Native Seed	20
4.5.3 Tube stock	20
4.5.4 Installation	20
4.5.5 Watering	21
4.5.6 Tree guards	21
4.6 Summary of management actions	21
5. Monitoring and review	24
6. References	26

Table index

Table 1.1	Roles and responsibilities for implementation of this VMP	3
Table 2.1	PCTs and corresponding TECs within the subject site	6
Table 2.2	Exotic species within the subject site and distribution per zone	7
Table 2.3	Priority weeds and Weeds of National Significance (WoNS)	8
Table 3.1	Management zones and objectives	10
Table 4.1	Target condition of each vegetation zone following management actions under this VMP	16
Table 4.2	General site procedures	18
Table 4.3	Summary of management actions	22
Table 5.1	Monitoring actions	25

Figure index

Figure 1	Site location	4
Figure 2	Masterplan concept design	5
Figure 3	Management zones and corresponding PCTs	14

Appendices

Appendix A	Revegetation species list and densities
Appendix B	Weed control guidelines
Appendix C	Example weed control proforma template

1. Introduction

GHD Pty Ltd (GHD) has been engaged by Loxford Project Management Pty Ltd (Loxford Project Management) to prepare this Vegetation Management Plan (VMP) to accompany a development application (DA) for a 356-lot subdivision at Cessnock Road, Gillieston Heights ('the proposal') (refer to Figure 1.1).

The proposal site is located within part of the buffer zone surrounding the former Hydro Aluminium Smelter site. Maitland City Council is proposing to rezone approximately 57.49 ha of this land that falls within the Maitland LGA from RU2 (Rural Landscape) to R1 (General Residential) land zoning (the proposal) (refer to Figure 1.2). Approximately 8.36 ha of vegetated land adjacent to the site will remain as RU2 and is the subject of this management plan (the subject site).

1.1 Purpose of this report

This VMP provides a framework for the management of vegetation adjacent to the proposal site including ecological restoration and ongoing weed management. Its purpose is to:

- Outline the management requirements of retained vegetation (Section 3).
- Specify the objectives of vegetation management at the site (Section 1.5).
- Detail required management activities (e.g. weed control) (Section 3).
- Detail the timing and responsibilities to complete management activities (Section 1.6 and 1.7).
- Specify monitoring and reporting schedules and requirements and triggers for any corrective actions (Section 5).

The VMP is a supporting document to the Development Application for residential subdivision. The VMP will provide management details about how the land that will continue to be zoned RU2 – Rural Landscape within the Maitland Local Government Area will be managed for weeds and revegetated (where appropriate) to a standard appropriate of an urban setting.

This VMP has been issued as a draft and will be updated with any conditions of consent issued by the approval authority.

A separate Wildlife Management Plan (WMP) will be prepared to detail how any impacts to native wildlife as a result of the proposal will be managed. The management actions of this VMP will result in beneficial outcomes for native wildlife by protecting native habitat, enhancing its ecological value and restoring habitat connectivity.

1.2 Scope and limitations

This report has been prepared by GHD for Loxford Project Management Pty Ltd and may only be used and relied on by Loxford Project Management Pty Ltd for the purpose agreed between GHD and Loxford Project Management Pty Ltd as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Loxford Project Management Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD is not responsible for any updates to this report that may be required following issue of Maitland City Council issuing conditions of consent for the project that may include specific conditions relating to the content of this VMP.

1.3 Terms and definitions

For the purposes of this VMP, the following definitions are implemented:

- The 'subject site' refers to the 8.36 ha of land that is the subject of this VMP.
- The 'proposal' refers to the proposed rezoning of 57.49 ha of land from RU2 to R1 within the Maitland LGA (adjacent to subject site).

1.4 Links to legislation, other plans and documents

Recommendations contained within this VMP are consistent with both State and Commonwealth legislation as well as local planning instruments and relevant guidance documents including:

- *Biodiversity Conservation Act 2016.*
- *Biosecurity Act 2015.*
- *Fisheries Management Act 1994.*
- *Water Management Act 2000.*
- *Pesticides Act 1999.*
- *Environment Protection and Biodiversity Conservation Act 1999.*
- Maitland City Council Local Environment Plan 2011.
- Hunter Regional Strategic Weed Management Plan 2017 – 2022.
- Controlled activities on waterfront land: guidelines for riparian corridors on waterfront land (NSW Office of Water 2012a).
- Guidelines for vegetation management plans on waterfront land (NSW Office of Water 2012b).

Other relevant reports reviewed during the completion of this plan include:

- EcoLogical (ELA) (2016), Hydro Aluminium Kurri Kurri –Biodiversity Assessment Report, unpublished report prepared for Hydro Aluminium.
- Cenwest Environmental Services (2004), Hydro Aluminium Kurri Kurri – Terrestrial Vertebrate Fauna Assessment, unpublished report prepared for Hydro Aluminium.
- GHD (2021) Hydro Aluminium Kurri Kurri Pty Ltd Biodiversity Certification Assessment Report.

1.5 Objectives

Vegetation management within the subject site will be focused on ecological restoration. No clearing within the subject site is proposed. The overall objectives of the VMP are to:

- Limit impacts to environmentally sensitive areas including riparian areas and TECs.
- Protect and restore native vegetation to enhance its ecological value and retain habitat connectivity.
- Achieve specified restoration targets (as specified in Section 4.1).
- Control weeds in an environmentally appropriate manner.

Management actions to meet these objectives broadly include:

- Installation of exclusion fencing
- Assisted natural regeneration
- Revegetation
- Weed control

Management actions and their application in each management zone are summarised in Section 4.6.

The Project Manager, in consultation with the Project Ecologist, Bush Regeneration Contractor and Weed Control Contractor, can adapt these criteria as required in response to the success of restoration works to ensure that the restoration objectives are achieved.

1.6 Timing

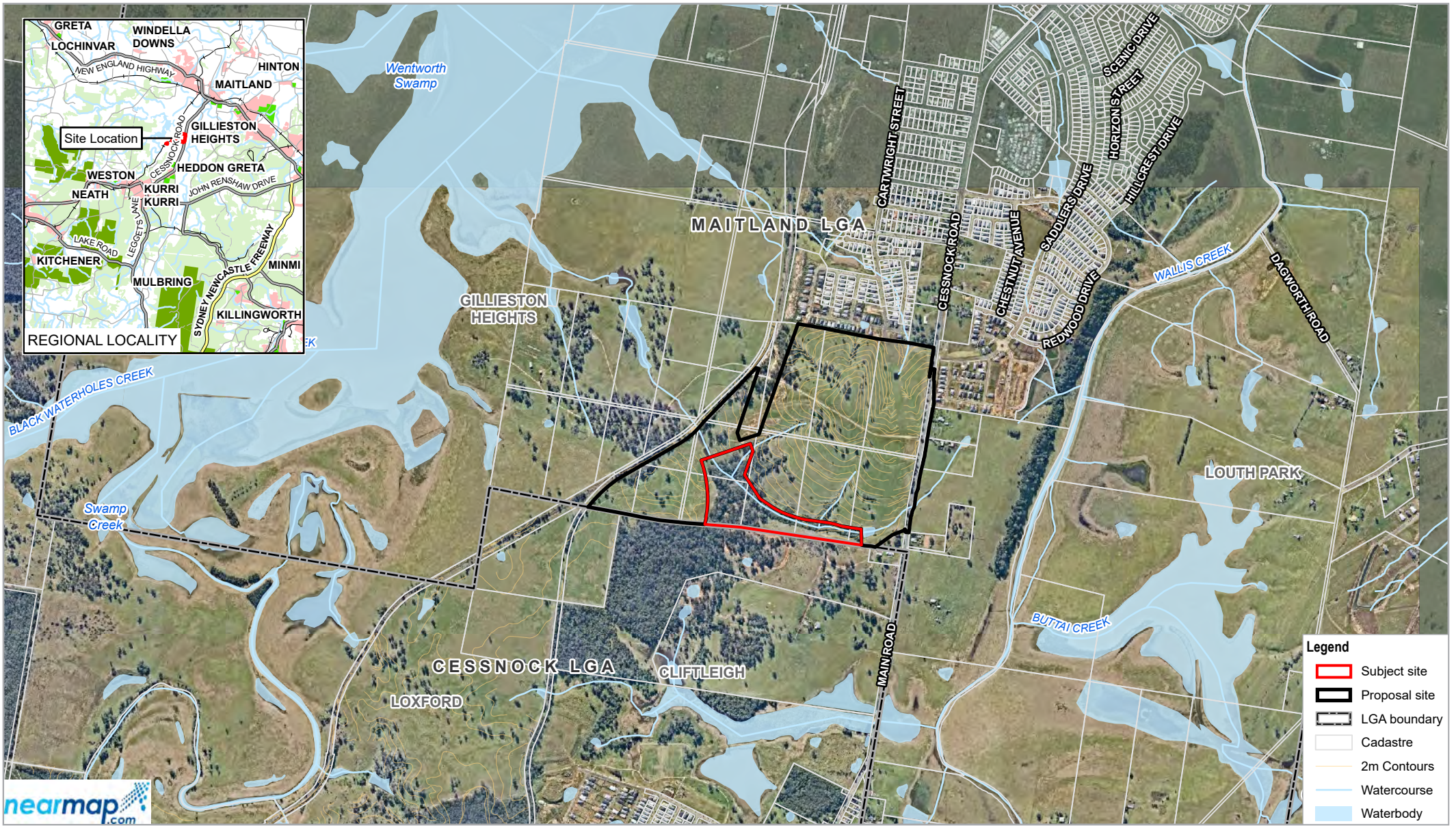
Implementation of this VMP will commence following its approval. The VMP will apply for ten years or until the performance criteria outlined in this VMP are met.

1.7 Roles and responsibilities

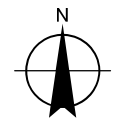
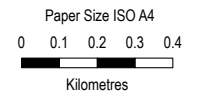
Table 1.1 provides details of key personnel with responsibilities associated with the proposed works and the management and mitigation of environmental impacts. All personnel involved in implementing the VMP will be suitably qualified with relevant specialist skills.

Table 1.1 Roles and responsibilities for implementation of this VMP

Roles and responsibilities for implementation of this VMP Role	Responsibility
Project Manager	The Project Manager is responsible for co-ordinating and overseeing works associated with the VMP. They will also keep all site monitoring and reporting documentation in the event that evidence is required for submission to Maitland City Council.
Project ecologist	Responsible for monitoring vegetation recovery
Bush regeneration contractor	Responsible for implementation of ecological restoration activities. Minimum of Conservation and Land Management (Natural Area Restoration and Management) Certificate II, plus a minimum of 500 hours of practical bushland regeneration experience under an experienced supervisor.
Weed control contractor	Responsible for implementation of weed control activities. Must hold a current chemicals application training certification to AQF Level 3 and comply with Occupational Health and Safety Standards.



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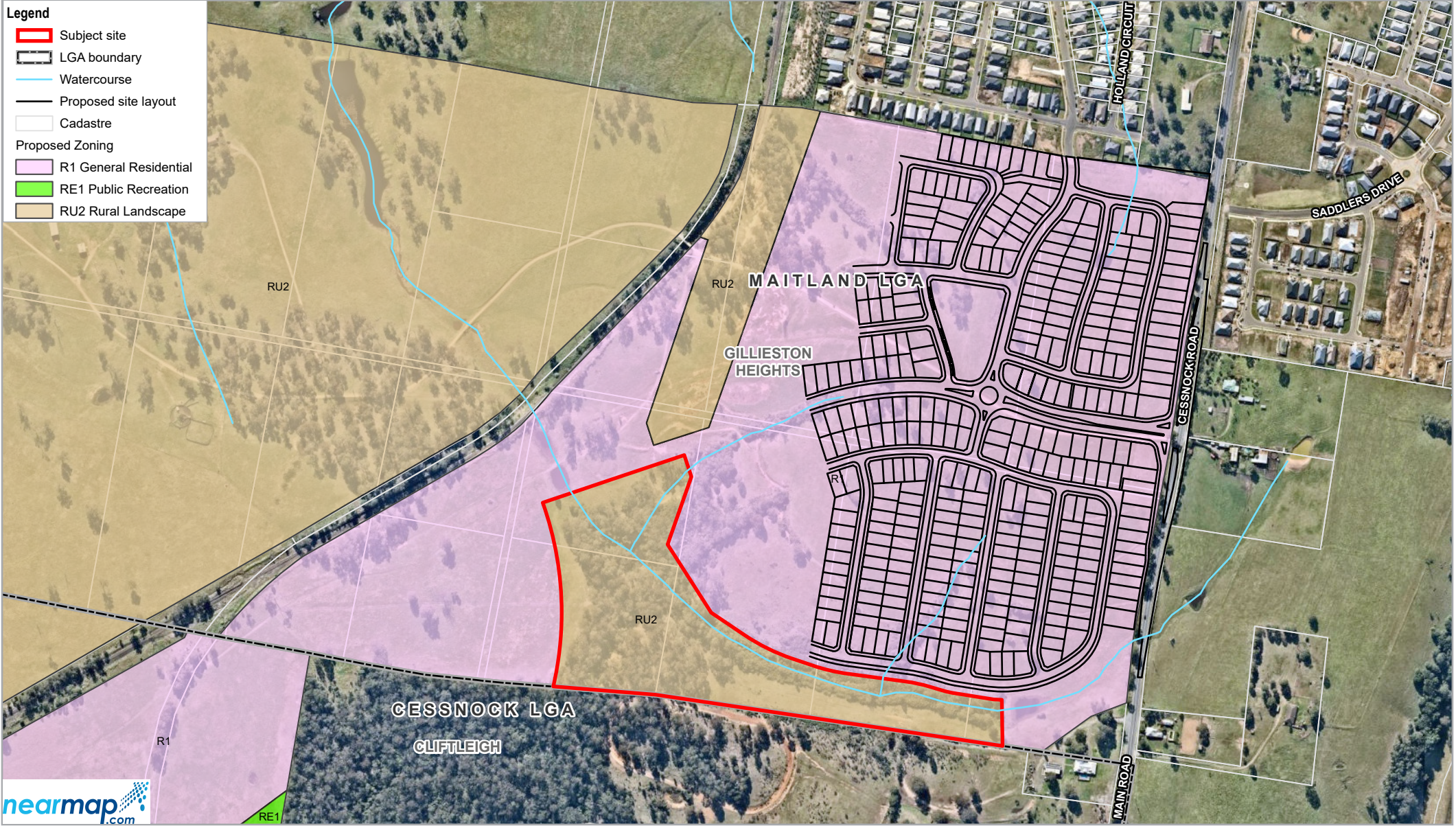
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 Revision No. **A**
 Date **20/01/2022**

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 Grid: GDA 1994 MGA Zone 56

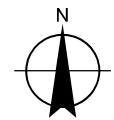
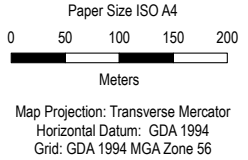
Site map

Figure 1.1

- Legend**
- Subject site
 - LGA boundary
 - Watercourse
 - Proposed site layout
 - Cadastre
- Proposed Zoning**
- R1 General Residential
 - RE1 Public Recreation
 - RU2 Rural Landscape



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Vegetation Management Plan

Project No. **12527690**
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Proposed site layout

Figure 1.2

2. Existing environment

2.1 Location

The subject site is located off Cessnock Road in the suburb of Gillieston Heights, approximately 30 km northwest of Newcastle Central Business District within the Maitland City Council LGA (Figure 1.1). It is located within the Hunter Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the Sydney Basin IBRA bioregion. It occurs within the Wallis Creek catchment. Wallis creek flows into the Hunter River approximately 10 km to the north of the subject site between East and West Maitland.

2.2 Existing land use

The subject site is currently zoned RU2 under the Maitland City Council Local Environment Plan 2011 (Maitland LEP). It comprises land associated with an ephemeral first order drainage line that feeds into Wentworth Swamp to the west. Most of this land contains remnant native vegetation in varying condition, surrounded by cleared agricultural land used for stock grazing consisting of exotic grassland with remnant scattered trees.

The land surrounding the subject site is currently the subject of a Planning Proposal to rezone the land from RU2 (rural lands) to R1 (residential). This land has been cleared and is currently utilised for cattle grazing. It contains scattered remnant trees, areas of young regrowth as well as small patches of remnant native vegetation. The proposal site also contains two small farm dams located either end of the drainage line that runs along the southern boundary and a third dam located in the northeast of the site

2.3 Existing vegetation

The subject site consists of the following plant community types (PCTs):

- PCT 1591 (intact) – Grey-Gum – Rough-barked Apple shrubby open forest of the Lower Hunter
- PCT 1600 (intact) – Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the Lower Hunter
- PCT 1591 (moderate) – Grey Gum – Rough-barked Apple shrubby open forest of the Lower Hunter
- Exotic grassland

A description of each PCT is provided in Table 3.1.

2.4 Threatened ecological communities

Two PCTs within the subject site correspond with Threatened Ecological Communities (TECs) listed under the Biodiversity Conservation Act 2016 (BC Act) (Table 2.1).

Table 2.1 PCTs and corresponding TECs within the subject site

PCT	TEC	BC Act Status	EPBC Act Status
PCT 1591	Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions	Endangered	-
PCT 1600	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	Endangered	-

2.5 Threatened flora

The subject site contains potential habitat for several threatened flora species recorded in close proximity to the site including:

- *Eucalyptus parramattensis* subsp. *parramattensis* (Parramatta Red Gum)
- *Grevillia parviflora* subsp. *parviflora* (Small Flowered Grevillia)
- *Callistemon linearifolius* (Netted Bottlebrush)
- *Acacia bynoeana* (Bynoe's Wattle)

None of these species or any other threatened flora species were observed within the subject site during surveys completed for this VMP.

2.6 Exotic flora

The *Biosecurity Act 2015* provides for the declaration of priority weeds in local government areas. All plants are regulated by a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

A total of eight exotic species were recorded within the subject site (Table 2.2). Other than in Zone 4 the subject site has a relatively low abundance of weeds with the majority of occurrences being scattered individuals.

Table 2.2 Exotic species within the subject site and distribution per zone

Scientific name	Common name	Zone			
		1	2	3	4
<i>Lantana camara</i>	Lantana		✓		
<i>Taraxacum officinalis</i>	Dandelion		✓	✓	✓
<i>Senecio madagascariensis</i>	Fireweed	✓			✓
<i>Conyza bonariensis</i>	Fleabane			✓	✓
<i>Ehrharta erecta</i>	Panic Veld Grass	✓			
<i>Cirsium vulgare</i>	Spear thistle				✓
<i>Solanum mauritianum</i>	Tobacco bush				
<i>Pennisetum clandestinum</i>	Kikuyu				✓
<i>Sida rhombifolia</i>	Paddy's Lucerne		✓		✓

Of the exotic species present within the subject site, two are listed as priority weeds under the *Biosecurity Act 2015*. These weeds are also considered to be Weeds of National Significance and Priority weeds for the Hunter Region (Table 2.3). Weed control activities will focus on eliminating Priority Weeds and WoNS from the site. Other environmental weeds listed above will also be controlled where practical.

Table 2.3 Priority weeds and Weeds of National Significance (WoNS)

Scientific name	Common name	WoNS	Biosecurity duty	Priority Weed for the Hunter Region
<i>Lantana camara</i>	Lantana	Yes	Prohibition on dealings Must not be imported into the State or sold	State Priority Weed Objective – Asset Protection Spread should be minimised to protect priority assets
<i>Senecio madagascariensis</i>	Fireweed	Yes	Prohibition on dealings Must not be imported into the State or sold	State Priority Weed Objective – Asset Protection Spread should be minimised to protect priority assets Weed of community concern for: Agricultural outcomes

2.7 Fauna habitats

A range of fauna habitat features are present throughout the subject site that provide a variety of potential foraging, breeding, roosting and nesting resources for native fauna. Key habitat features include:

- Hollow-bearing trees (roosting / breeding habitat for arboreal mammals, microbats, birds)
- Ephemeral drainage line (habitat for amphibians, reptiles, birds, microbats and marsupials)
- Leaf litter / woody debris (shelter and foraging habitat for insects, birds, reptiles, frogs, small mammals)
- Mature flowering Eucalypt trees (foraging habitat for nectar-feeding birds and Flying-foxes)
- Habitat connectivity (vegetation within the subject site is part of an identified local wildlife corridor)

The objectives of this VMP are consistent with maintaining and improving the fauna habitat values of the site.

2.8 Environmental constraints

The subject site contains an ephemeral first order drainage line. The vegetated riparian zone (VRZ) for this drainage line extends 10 m either side of the watercourse (NSW Office of Water 2012a) (refer to Figure 3.1).

The restoration works outlined in this VMP will enhance the ecological function of the VRZ by protecting and restoring native vegetation structure and removing threats such as damage by stock and invasion of exotic weeds.

VRZ are vulnerable and easily degraded. General site procedures described in Section 4.2 will be implemented to ensure management actions will not result in negative outcomes for the VRZ (such as introduction of pathogens).

3. Management zones

Ecological restoration will be focused on four management zones that correspond with the current condition and management requirements of existing vegetation within the subject site. These zones and their management objectives are described in Table 3.1 and shown in Figure 3.1.

The tasks associated with each vegetation management objective are described in Section 5.6.












Table 3.1 Management zones and objectives

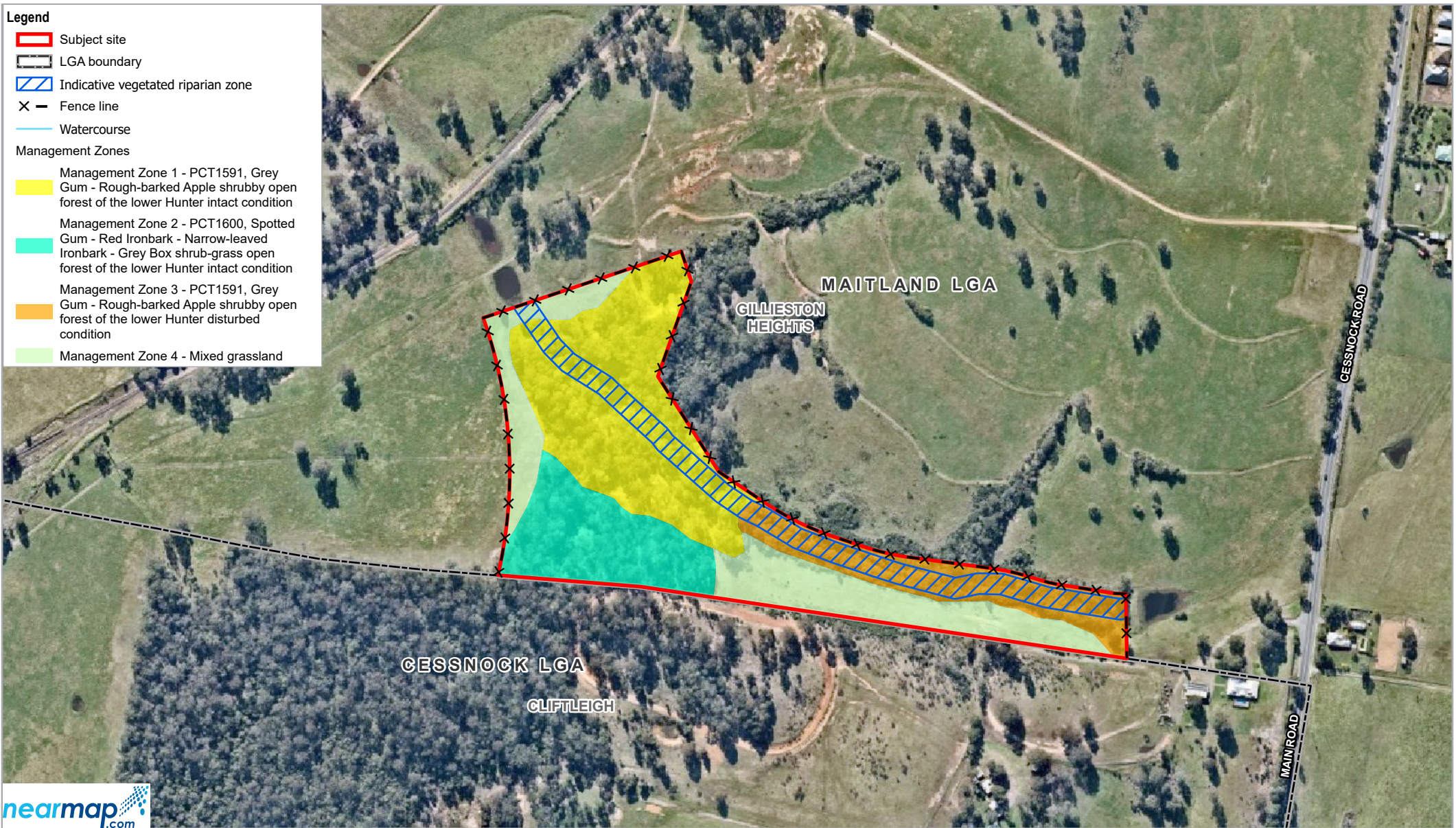
Zone	PCT Association	Area	Description	Vegetation management objectives
1	PCT 1591 (intact)	3.34	<p>Grey-Gum – Rough-barked Apple shrubby open forest of the Lower Hunter</p> <p>Condition Good</p> <p>Description Remnant native vegetation with relatively intact overstorey, shrub and ground layer supporting a high native species richness. Leaf litter and woody debris present and a moderate number of hollow-bearing trees and fallen timber.</p> <p>Structure An open forest to 20 m with a typically shrubby midstorey and sparse ground layer dominated by grasses, small ferns and forbs.</p> <p>Characteristic Species The canopy structure within this vegetation community is dominated by <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora floribunda</i> (Rough-barked Apple) with smaller occurrences of <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) and <i>Eucalyptus agglomerata</i> (Blue-leaved Stringybark)</p> <p>The diverse shrub layer within this vegetation community dominated by <i>Melaleuca nodosa</i>, <i>Leptospermum polygalifolium</i> and <i>Bursaria spinosa</i> (Native Blackthorn). Other shrub species which occur at a smaller percentage cover include <i>Daviesia ulicifolia</i> (Gorse Bitter Pea), <i>Pultenaea spinosa</i> (A Bush Pea), <i>Dillwynia retorta</i>, <i>Acacia ulicifolia</i> (Prickly Moses), <i>Zieria smithii</i>, <i>Hakea sericea</i> (Needlebush), <i>Pittosporum undulatum</i> (Sweet Pittosporum) and <i>Denhamia silvestris</i> (Narrow-leaved Orangebark).</p> <p>The groundlayer is characterised by native grass species, including <i>Entolasia stricta</i> (Wiry Panic), <i>Cynodon dactylon</i> (Common Couch), <i>Aristida vagans</i> (Threeawn Speargrass) and <i>Eragrostis brownii</i> (Brown's Lovegrass). Additional native ground cover species include <i>Lomandra cylindrica</i>, <i>Hardenbergia violacea</i> (False Sarsaparilla), <i>Pomax umbellata</i> (Pomax), <i>Commelina cyanea</i> (Native Wandering Jew) and <i>Cassytha glabella</i>.</p> <p>Weed cover Two exotic species observed were recorded at very low percentage cover: <i>Ehrharta erecta</i> (Panic Veldtgrass) and <i>Senecio madagascariensis</i> (Fireweed).</p>	<p>Protect and enhance the ecological community through:</p> <ul style="list-style-type: none"> exclusion fencing natural regeneration weed control

Zone	PCT Association	Area	Description	Vegetation management objectives
2	PCT 1600 (intact)	1.55	<p>Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the Lower Hunter</p> <p>Condition</p> <p>Good</p> <p>Description</p> <p>Remnant native vegetation with relatively intact overstorey, shrub and ground layer. Supports a high native species richness for trees and shrubs. Low abundance of exotic species. Leaf litter and woody debris and a moderate number of hollow-bearing trees and fallen timber.</p> <p>Structure</p> <p>An open forest with a typically shrubby midstorey and the ground layer is dominated by grasses with a mix of graminoids; small ferns and forbs</p> <p>Characteristic Species</p> <p>The canopy within this vegetation community is dominated by <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) and <i>Eucalyptus fibrosa</i> (Red Ironbark) with <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus moluccana</i> (Grey Box) also occurring occasionally. <i>Notelaea longifolia</i> (Large Mock-olive) also occurs in low abundance within the canopy stratum.</p> <p>The shrub stratum is characterised by <i>Melaleuca nodosa</i> and <i>Bursaria spinosa</i> (Native Blackthorn). Other common species include <i>Myrsine variabilis</i>, <i>Breynia oblongifolia</i> (Coffee Bush), <i>Melaleuca sieberi</i>, <i>Callistemon linearis</i> (Narrow-leaved Bottlebrush) and <i>Melaleuca linariifolia</i> (Flax-leaved Paperbark). The lower shrub layer includes species such as <i>Pultenaea retusa</i> (Notched Bush-pea), <i>Pultenaea spinosa</i> (Spiny Bush-pea), <i>Correa reflexa</i> (Native Fuchsia) and <i>Hibbertia vestita</i> (Hairy Guinea Flower).</p> <p>The ground layer is characterised by native grass species including <i>Entolasia stricta</i> (Wiry Panic), <i>Cynodon dactylon</i> (Common Couch), <i>Imperata cylindrica</i> (Blady Grass) <i>Aristida vagans</i> (Threeawn Speargrass), <i>Microlaena stipoides</i> (Weeping Grass), <i>Themeda triandra</i> (Kangaroo Grass) and <i>Eragrostis brownii</i> (Brown's Lovegrass). Other common species include <i>Lomandra cylindrica</i>, <i>Lomandra filiformis</i> (Wattle Matt-rush), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Lomandra confertifolia</i> (Matrush), <i>Lomandra multiflora</i> (Many-headed Mat-rush), <i>Pratia purpurascens</i> (Whiteroot) <i>Hardenbergia violacea</i> (False Sarsaparilla), <i>Lepidosperma laterale</i> (<i>Pomax umbellata</i> (Pomax), <i>Brunoniella australis</i> (Blue Trumpet) <i>Commelina cyanea</i> (Native Wandering Jew) and <i>Cassytha pubescens</i>.</p> <p>Weed cover</p> <p>Low weed abundance and diversity. Weeds of concern include <i>Lantana camara</i> (Lantana) and <i>Sida rhombifolia</i> (Paddy's Lucerne).</p>	<p>Protect and enhance the ecological community through:</p> <p>Exclusion fencing</p> <p>Natural regeneration</p> <p>Weed control</p>

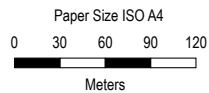
Zone	PCT Association	Area	Description	Vegetation management objectives
3	PCT 1591 (moderate)	1.35	<p>Grey Gum – Rough-barked Apple shrubby open forest of the Lower Hunter</p> <p>Condition Moderate</p> <p>Description This vegetation zone has been disturbed in parts through past clearing of the canopy. Along the eastern portion of the drainage line the community consist of thickets of <i>Melaleuca nodosa</i> with a sparse canopy. Habitat complexity and species diversity increases in the western portion of the site.</p> <p>Structure An open forest to 20 m with a typically shrubby mid storey and sparse ground layer dominated by grasses, small ferns and forbs.</p> <p>Characteristic Species Overstorey dominated by sparse <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora floribunda</i> (Rough-barked Apple) with occasional <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) and <i>Eucalyptus agglomerata</i> (Blue-leaved Stringybark). Diverse shrub layer dominated by <i>Melaleuca nodosa</i>, <i>Leptospermum polygalifolium</i> and <i>Bursaria spinosa</i> (Native Blackthorn). Other shrub species which occur at a smaller percentage cover include <i>Daviesia ulicifolia</i> (Gorse Bitter Pea), <i>Pultenaea spinosa</i> (A Bush Pea), <i>Dillwynia retorta</i>, <i>Acacia ulicifolia</i> (Prickly Moses), <i>Zieria smithii</i>, <i>Hakea sericea</i> (Needlebush), <i>Pittosporum undulatum</i> (Sweet Pittosporum) and <i>Denhamia silvestris</i> (Narrow-leaved Orangebark). The groundlayer is characterised by native grass species, including <i>Entolasia stricta</i> (Wiry Panic), <i>Cynodon dactylon</i> (Common Couch), <i>Aristida vagans</i> (Threeawn Speargrass) and <i>Eragrostis brownii</i> (Brown's Lovegrass). Additional native ground cover species include <i>Lomandra cylindrica</i>, <i>Hardenbergia violacea</i> (False Sarsaparilla), <i>Pomax umbellata</i> (Pomax), <i>Commelina cyanea</i> (Native Wandering Jew) and <i>Cassytha glabella</i>.</p> <p>Weed cover Relatively low abundance and diversity of exotic species. Some larger patches of <i>Ehrharta erecta</i> (Panic Veldtgrass and occasional <i>Senecio madagascariensis</i> (Fireweed), <i>Solanum mauritanum</i> (Tobacco Bush), <i>Lantana camara</i> (Lantana) and <i>Solanum nigrum</i> (Blackberry Nightshade).</p>	<p>Reinstate the ecological community through: Exclusion fencing Natural regeneration Weed control</p>

Zone	PCT Association	Area	Description	Vegetation management objectives
4	N/A	2.12	<p>Exotic grassland</p> <p>Condition Poor</p> <p>Description Disturbed, cleared mixed grassland occurring at the edges of native vegetation communities.</p> <p>Structure Vegetation consists of exotic groundcover species with no canopy or shrub layer other than occasional scattered remnant trees.</p> <p>Characteristic Species Native ground cover has a very low diversity and is dominated by exotic species including <i>Vulpia bromoides</i> (Squirrel Tail Fescue), <i>Ambrosia artemisiifolia</i> (Annual Ragweed), <i>Paspalum notatum</i> (Bahia Grass) and <i>Setaria parviflora</i>. Small patches also contain a higher abundance of the native grasses <i>Cynodon dactylon</i> (Common Couch) and, <i>Microleana stipoides</i> (Weeping Grass). Other natives to be observed within the plots, but at very low percentage covers include <i>Microtis parviflora</i> (Slender Onion Orchid), <i>Cheilanthes sieberi</i> (Rock Fern), <i>Eragrostis brownii</i> (Brown's Lovegrass), <i>Dichelachne micrantha</i> (Shorthair Plumegrass), <i>Themeda triandra</i> (Kangaroo Grass), <i>Einadia nutans</i> (Ruby Saltbush) and <i>Wahlenbergia gracilis</i> (Sprawling Bluebell).</p> <p>Weed cover The ground storey is dominated by exotic grasses and herbaceous species including <i>Ambrosia artemisiifolia</i> (Annual Ragweed), <i>Hypochaeris radicata</i> (Catsear), <i>Vulpia bromoides</i> (Squirrel Tail Fesque), <i>Senecio madagascariensis</i> (Fireweed), <i>Lotus subbiflorus</i> (Hairy Birds-foot Trefoil), <i>Trifolium repens</i> (White Clover), <i>Facelis retusa</i> (Annual Trampweed) and <i>Paspalum dilatatum</i> (Paspalum).</p>	<p>Reinstate the ecological community through:</p> <p>Exclusion fencing</p> <p>Revegetation</p> <p>Weed control</p>

- Legend**
-  Subject site
 -  LGA boundary
 -  Indicative vegetated riparian zone
 -  Fence line
 -  Watercourse
- Management Zones**
-  Management Zone 1 - PCT1591, Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter intact condition
 -  Management Zone 2 - PCT1600, Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter intact condition
 -  Management Zone 3 - PCT1591, Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter disturbed condition
 -  Management Zone 4 - Mixed grassland



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Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Loxford Project Group Pty Ltd
Regrowth Kurri Kurri – Maitland LGA
Vegetation Management Plan

Project No. 12527690
 Revision No. A
 Date 24/01/2022

Management zones

Figure 3.1

4. Management actions

4.1 Restoration targets

Restoration targets have been guided by identified ecosystem attributes including composition (species), structure (complexity and configuration) and function (processes and dynamics) associated with the benchmark (pre-disturbance) state of each vegetation type (PCT). These descriptions have been adapted from previous biodiversity data collected from the site (GHD 2021) and represent the target ecosystem attributes to be achieved as a result of ecological restoration.

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Table 4.1 Target condition of each vegetation zone following management actions under this VMP

Target condition	Zone 1	Zone 2	Zone 3	Zone 4
PCT	1591	1600	1591	Mixed grassland – restored to PCT 1591
Description	Open forests dominated by <i>Eucalyptus punctata</i> . The mid-storey is typically shrubby and the ground layer is dominated by grasses with a mix of graminoids, small ferns and forbs.	Open forests with a canopy dominated by <i>Corymbia maculata</i> . The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.	Open forests dominated by <i>Eucalyptus punctata</i> . The mid-storey is typically shrubby and the ground layer is dominated by grasses with a mix of graminoids, small ferns and forbs.	Open forests dominated by <i>Eucalyptus punctata</i> . The mid-storey is typically shrubby and the ground layer is dominated by grasses with a mix of graminoids, small ferns and forbs.
Upper stratum species (at least 2)	<i>Eucalyptus punctata</i> ; <i>Angophora floribunda</i> Cover 20-40 %	<i>Corymbia maculata</i> ; <i>Eucalyptus fibrosa</i> ; <i>Eucalyptus crebra</i> ; <i>Eucalyptus moluccana</i> Cover 20-40 %	<i>Eucalyptus punctata</i> ; <i>Angophora floribunda</i> Cover 20-40 %	<i>Eucalyptus punctata</i> ; <i>Angophora floribunda</i> Cover 20-40 %
Mid stratum species (at least 5)	<i>Persoonia linearis</i> ; <i>Bursaria spinosa</i> ; <i>Acacia parvipinnula</i> ; <i>Grevillea montana</i> ; <i>Leptospermum trinervium</i> ; <i>Jacksonia scoparia</i> ; <i>Lissanthe strigosa</i> ; <i>Leucopogon juniperinus</i> ; <i>Melaleuca nodosa</i> Cover 5-30%	<i>Bursaria spinosa</i> ; <i>Daviesia ulicifolia</i> ; <i>Acacia parvipinnula</i> ; <i>Breynia oblongifolia</i> ; <i>Leucopogon juniperinus</i> ; <i>Lissanthe strigosa</i> ; <i>Maytenus silvestris</i> ; <i>Ozothamnus diosmifolius</i> ; <i>Panicum simile</i> ; <i>Glycine clandestina</i> Cover 10-30 %	<i>Persoonia linearis</i> ; <i>Bursaria spinosa</i> ; <i>Acacia parvipinnula</i> ; <i>Grevillea montana</i> ; <i>Leptospermum trinervium</i> ; <i>Jacksonia scoparia</i> ; <i>Lissanthe strigosa</i> ; <i>Leucopogon juniperinus</i> ; <i>Melaleuca nodosa</i> Cover 5-30%	<i>Persoonia linearis</i> ; <i>Bursaria spinosa</i> ; <i>Acacia parvipinnula</i> ; <i>Grevillea montana</i> ; <i>Leptospermum trinervium</i> ; <i>Jacksonia scoparia</i> ; <i>Lissanthe strigosa</i> ; <i>Leucopogon juniperinus</i> ; <i>Melaleuca nodosa</i> Cover 5-30%
Lower stratum species (at least 8)	<i>Themeda australis</i> ; <i>Microlaena stipoides</i> ; <i>Imperata cylindrica</i> ; <i>Panicum simile</i> ; <i>Aristida vagans</i> ; <i>Cheilanthes sieberi</i> ; <i>Pomax umbellata</i> ; <i>Lomandra longifolia</i> ; <i>Entolasia stricta</i> ; <i>Cymbopogon refractus</i> Cover 80-100 %	<i>Aristida vagans</i> ; <i>Themeda australis</i> ; <i>Lomandra confertifolia</i> ; <i>Lomandra filiformis</i> ; <i>Vernonia cinerea</i> ; <i>Brunoniella australis</i> ; <i>Pratia purpurascens</i> ; <i>Cheilanthes sieberi</i> ; <i>Cymbopogon refractus</i> ; <i>Dianella revoluta</i> ; <i>Dianella caerulea</i> ; <i>Entolasia stricta</i> ; <i>Goodenia hederacea</i> subsp. <i>hederacea</i> ; <i>Hardenbergia violacea</i> ; <i>Lomandra filiformis</i> ; <i>Lomandra multiflora</i> ; Cover 80-100 %	<i>Themeda australis</i> ; <i>Microlaena stipoides</i> ; <i>Imperata cylindrica</i> ; <i>Panicum simile</i> ; <i>Aristida vagans</i> ; <i>Cheilanthes sieberi</i> ; <i>Pomax umbellata</i> ; <i>Lomandra longifolia</i> ; <i>Entolasia stricta</i> ; <i>Cymbopogon refractus</i> Cover 80-100 %	<i>Themeda australis</i> ; <i>Microlaena stipoides</i> ; <i>Imperata cylindrica</i> ; <i>Panicum simile</i> ; <i>Aristida vagans</i> ; <i>Cheilanthes sieberi</i> ; <i>Pomax umbellata</i> ; <i>Lomandra longifolia</i> ; <i>Entolasia stricta</i> ; <i>Cymbopogon refractus</i> Cover 80-100 %
Weed cover	Maximum 5%	Maximum 5%	Maximum 5%	Maximum 10 %
Conservation significance	Consistent with EEC	Consistent with EEC	Consistent with EEC	Consistent with EEC

4.2 General site procedures

Exotic flora species are already present within the site in low abundance however, increased visitation and disturbance of soil has the potential to increase the introduction and spread of exotic plants. It is important that weeds and pathogens are not allowed to establish on the site or spread to other areas. It is also important environmentally sensitive areas such as the VRZ are not disturbed as a result of management action. Procedures described in Table 4.2 will be implemented to ensure negative outcomes at the site do not occur as a result of management actions contained within this VMP.

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Table 4.2 General site procedures

Controls	Procedures	Timing	Responsibility
Inductions	<p>All contractors will complete a site environmental induction including details regarding:</p> <ul style="list-style-type: none"> – Priority weeds and WoNS occurring and with potential to occur at the site – Requirements for all personnel to report sightings of priority weeds or WoNS to the STP Site Manager. – Weed and pathogen hygiene controls described in this plan to be acknowledged and adhered to. – Location of the VRZ 	Prior to personnel commencing site tasks	All personnel
Weed hygiene controls	<p>The following procedures will be implemented to minimise the risk of spread / invasion of weeds to / from the site:</p> <ul style="list-style-type: none"> – Any machinery used on site will follow biosecurity measures, including a thorough inspection prior to entry to the site to look for any weed matter that may pose a biosecurity risk. Inspections will be recorded in a register and kept on file. – Any machinery carrying potential weed matter will undergo appropriate wash-down procedures in a controlled location. – Wash down areas on site must not be located within 20 m of native vegetation or water bodies. Dirty water is to be disposed of appropriately. – Restrict vehicles to designated tracks, trails and parking areas. – Light vehicles driving around site will follow biosecurity measures, including a thorough inspection prior to entry and exit of the site for any weed matter that may pose a biosecurity risk. – Any removed propagative weed material will be bagged, removed from site and disposed of at a registered green waste facility. 	Ongoing during all site tasks	All personnel
Pathogen hygiene controls	<p>All works on site should follow appropriate hygiene controls to reduce the risk of introduction or spread of the following pathogens:</p> <ul style="list-style-type: none"> – Chytrid Fungus (<i>Batrachochytrium dendrobatidis</i>) – an infectious disease that affects amphibians. – <i>Phytophthora cinnamomi</i> – a soil borne pathogen that causes plant disease and death. – Myrtle Rust (<i>Uredo rangelii</i>) – an exotic fungus causing plant disease and death. <p>Procedures include:</p> <ul style="list-style-type: none"> – Avoiding work during excessively wet or muddy conditions – All personnel to be inducted on pathogen management measures – Restrict vehicles to designated tracks, trails and parking areas – Wash down boots prior to leaving site at an appropriate location. Disinfect with cleaning products containing 70% methylated spirits in 30 % water. 	Ongoing during all site tasks	All personnel
Protection of the VRZ	<p>Procedures to protect the VRZ include:</p> <ul style="list-style-type: none"> – Avoid work during excessively wet or muddy conditions – All personnel to be notified in site inductions of the extent of the VRZ – No vehicles to enter the VRZ – Follow appropriate pathogen hygiene controls described above – Avoid use of herbicides within the VRZ and use physical weed removal methods where possible and appropriate at the discretion of the weed control contractor 	Ongoing during all site tasks	All personnel

4.3 Weed control

Weed monitoring and control is required to reduce weed cover and identify and respond to re-emergence of weed species or new weed infestations that have the potential to compromise the restoration works and to identify appropriate responses.

Appropriate weed removal techniques for exotic species should be implemented by a qualified bush regeneration contractor. Weed control must be carried out in a manner that minimises negative environmental impacts such as over-clearing that may result in erosion and sedimentation and destruction of fauna habitat. Weed management should align with appropriate State and Commonwealth legislation and guidelines including (but not limited to):

- *Pesticides Act 1999*.
- *Biosecurity Act 2015*.
- *Water Management Act 2000*.
- Garden Escapees and Other Weeds of Bushland and Reserves, 3rd Edition (Great Lakes Council 2015).
- NSW Weeds Control Handbook- a guide to weed control in non-crop aquatic and bushland situations (DPI 2018).

Weed biomass should be either composted on-site or disposed of at an approved weed management centre in compliance with the *Biosecurity Act 2015*.

Chemical treatments methods will follow those described in the New South Wales Weed Control Handbook (DPI 2018) and be conducted in accordance with the *Pesticides Act 1999*. The following protocols for chemical weed control should be followed:

- The weed control contractor is to select the most appropriate herbicide based on the information within this plan and current best practices for weed control.
- Pesticide users must hold a current chemicals application training certification to AQF Level 3 and comply with Occupational Health and Safety Standards.
- A Material Safety Data Sheet (MSDS) for herbicides is to be used, read and carried by personnel involved with weed control activities.
- Foliar spraying is only to be undertaken during periods of low wind (less than 10 km/hr) to reduce overspray.
- All pesticide users should take reasonable care to protect their own health and the health of others when using a pesticide.
- All pesticide users should make every reasonable attempt to protect sensitive areas on site or harm to native species.

Only herbicides that are suitable for environmentally sensitive areas such as those described as “frog-friendly” (e.g. Roundup Biactive or equivalent) should be used in sensitive areas such as the VRZ.

Weed control management actions, timing and responsibility are detailed in Table 4.3.

Additional chemical weed control, or other weed control techniques may be required in subsequent weed management events beyond those described in Table 4.3. The need for this will be informed by the results of the monitoring and reporting program as detailed in Section 5.

Weed control guidelines for priority weeds are detailed in Appendix B.

An example weed control proforma is provided in Appendix C.

4.4 Top Soil Preparation

Vegetation zone 4 has been subject to compaction from long term cattle grazing. To improve conditions for seed germination scarifying/ripping (to 300 mm deep) of topsoil will be necessary to reduce soil compaction and provide a suitable seedbed for germination of native plants. This will be undertaken when the soil is relatively dry (summer or autumn).

All disturbed areas are to have topsoil replaced where appropriate and mulch spread over the roughened/scarified soil. Mulching will assist with absorbing precipitation and retaining moisture levels following rainfall, increasing the surface area and preventing scouring and erosion from surface flows.

4.5 Revegetation guidelines

Management actions for revegetation including timing and responsibilities are detailed in Table 4.3.

4.5.1 Direct seeding

Direct seeding is the delivery of native seeds into the soil using a mechanical seeder. Acacias and other legumes fix nitrogen in the soil while growing and can therefore greatly improve soil condition. Many of these plants also flower heavily and are therefore very attractive to birds and insects. The addition of these pollinators into the revegetation work adds diversity and brings opportunities for natural regeneration.

Direct seeding can be a cost efficient way to establish native vegetation when 'reconstructing' vegetation communities. This method will be used to re-establish a native groundcover within vegetation zone 4.

4.5.2 Hand Broadcasting of Native Seed

To supplement the establishment of native trees, shrubs and lower story, native grass seeds will be hand broadcast throughout the maintenance period of the restoration program. This will add further diversity to the site, particularly ground covers, and assist in achieving targets for planting densities.

4.5.3 Tube stock

Planting of tube-stock for trees and shrub species and Hiko or Viro cells will be utilised. Advanced stock will not be used for rehabilitation purposes. Local provenance species are to be used for revegetation. Plants may be sourced from seed collection and propagation or will be purchased from a local bush regeneration nursery. Plants should not be purchased from a commercial nursery as the provenance of these plants is probably unknown.

Appendix A provides a list of species suitable for planting within each management zone and the recommended planting densities, where required. The table lists a more than adequate number of species, to allow for the non-availability of some species. Horticultural varieties and cultivars are not acceptable under any circumstance.

Stock for revegetation should be sourced as early as possible to ensure availability.

The species listed are:

- Associated with the appropriate vegetation type.
- Expected to be available as local provenance through seed collection and propagation or tubestock from a local bush regeneration nursery.
- Likely to have good survival rates in the subject area under the proposed site preparation and maintenance regime.

4.5.4 Installation

Planting should occur at a time that will maximise survival rates as determined by the Bush Regeneration Contractor based on the date of commencement of the VMP, prevailing weather conditions and timing of weed control activities at the site.

Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each tubestock should be at least 1.5 x the width and 2 x the depth of the root ball. Fertiliser and water crystals should be added to each hole dug as per the label specifications. Water crystals will be treated prior to planting to ensure they are at their full extent so as not to push any seedling out of the ground once planted.

4.5.5 Watering

Seedlings should be initially watered in with at least 1 L of water and follow up watering every second day for two weeks (or at the discretion of the bush regeneration contractor based on prevailing weather conditions or if plants are deemed to have sufficient water supply from water crystals). If significant rainfall occurs post planting irrigation is only required every 5 days. Irrigation will be required if rainfall does not occur within a 5-day period, irrigation should continue for at least 6 weeks or until the bush regeneration contractor determines the plants have established successfully and irrigation can be phased out.

4.5.6 Tree guards

To improve seedling survival plan for plantings prior to small rainfall events. Tree guards are recommended for canopy species to provide protection from browsing.

4.6 Summary of management actions

The management actions that will be undertaken to meet the objectives of the VMP are provided in Table 4.3.

Table 4.3 Summary of management actions

Activity	Applicable zone	Task	Performance criteria	Timing	Responsibility
1. Source required personnel	All zones	Source Bush Regeneration Contractor and Weed control Contractor	Suitably qualified personnel (see section 1.7) engaged	Within three months of the commencement of this VMP	Project manager
2. Source local provenance tubestock and seed	Zone 4	Contact local suppliers to ensure availability of local tubestock and seed	Order placed for seed and tubestock to meet required planting densities (refer to Appendix A)	Within three months of engaging Bush Regeneration Contractor.	Bush Regeneration Contractor
3. Exclusion fencing	All zones	Installation of exclusion fencing as shown in Figure 3.1.	Fencing installed that follows best practice for stock proof fencing including wildlife friendly fencing guidelines.	Within three months of the commencement of this VMP	Site manager
4. Establish photo monitoring points	Two photo monitoring points will be established per management zone Two additional points will be established within the VRZ.	<ul style="list-style-type: none"> - Photo monitoring points will be established within the site with a capped star picket or surveyors peg. - The location will be recorded with a GPS so the point can be located easily, especially in the event the marker is knocked down or removed. 	<ul style="list-style-type: none"> - Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. - Photos will be labelled with the: <ul style="list-style-type: none"> • Photo point code. • Direction of view. • Date and time. 	Within three months of the commencement of this VMP	Project ecologist
5. Control of Fireweed	All zones	<ul style="list-style-type: none"> - Chemical spot spraying of Fireweed seedlings - Hand weeding of individual plants 	<ul style="list-style-type: none"> - Less than 10% of original weeds remaining 	Chemical control occurs once in the first year (March – May). Follow up hand weeding annually in Spring (Sept – Nov) if required.	Weed control contractor
6. Control of Lantana	Zone 2	Suppress growth and eradicate infestations. Chemical or manual control as determined by the weed control contractor.	<ul style="list-style-type: none"> - All Lantana individuals eradicated. 	Year 1	Weed control contractor
7. General weed control	All zones	Spot spraying of annual and perennial weeds once every three months	<ul style="list-style-type: none"> - Less than 5% cover of exotic species 	Years 1 – 2	Weed control contractor

Activity	Applicable zone	Task	Performance criteria	Timing	Responsibility
8. Annual maintenance weed control	All zones	Chemical or physical weed removal as required. Frequency to be determined by the weed control contractor based on the outcomes of previous weed control.	<ul style="list-style-type: none"> - No mature woody weeds remaining - Priority weeds less than 5% cover - Exotic groundcover less than 5% 	Years 2-5	Weed control contractor
9. Revegetation	Zone 4	Replanting to restore native vegetation communities. Refer to section 5.5 for revegetation guidelines.	85% survival rate of tubestock. A 50% coverage of native groundcover with at least 8 groundcover species, 5 shrub species and 2 canopy species that are consistent with restoration targets in Section 4.1.	Within 18 months of commencement of this VMP	Bush regeneration contractor
			80% coverage of native groundcover with at least 8 groundcover species and 3 shrub species and 2 canopy species that are consistent with restoration targets in Section 4.1.	Year 3	Bush regeneration contractor
			90% coverage of native groundcover Restoration targets in Section 4.1 achieved	Years 4-5	Bush regeneration contractor
10. Supplementary planting if: <ul style="list-style-type: none"> • Original tube stock has less than 85% survival rate • performance criteria have not been met 	All zones	Replacement or infill planting of tubestock	85% survival rate of tubestock. Revegetation performance criteria are met.	Annual checks and plantings where required to meet performance criteria	Bush regeneration contractor

5. Monitoring and review

Monitoring actions to meet the objectives of the VMP are provided in Table 5.1.

An adaptive management approach should be employed during the implementation of this VMP to ensure that the objectives of the VMP are achieved. This will include a process of monitoring, reviewing and then implementing corrective actions in response to the status of weed growth, the health and survival of plantings, natural regeneration rates of native vegetation and prevailing weather conditions as outlined in Table 5.1.

The Project Manager, in consultation with the Project Ecologist, Bush Regeneration Contractor and Weed Control Contractor, can adapt the actions described in this VMP where required, as long as any changes comply with the purpose and objectives of this VMP, and any licensing or approval conditions issued. Such changes may include (but not limited to):

- Application rates for fertiliser.
- Watering schedule.
- Species composition or planting densities if required by availability or survival rates of a particular species or stock.
- Schedule of weed control activities if they are meeting or not meeting performance indicators.

Table 5.1 **Monitoring actions**

Activity	Applicable zone	Task	Performance criteria	Timing	Responsibility
Photo monitoring surveys	All zones	<ul style="list-style-type: none"> – Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. – Photos will be labelled with the: <ul style="list-style-type: none"> • Photo point code. • Direction of view. • Date and time. 	<ul style="list-style-type: none"> – Photos must accompany monitoring reports in an appropriate file format (e.g.jpeg) to enable comparison between monitoring events. 	Annually in spring	Project ecologist
Annual monitoring reports	All zones	<p>Complete an annual report to evaluate the success of the VMP.</p> <p>Monitoring reports will be submitted to the Project Manager.</p>	<p>Reporting will address the following:</p> <ul style="list-style-type: none"> – Describe weed control measures undertaken and their success against VMP objectives and performance criteria. – Describe any revegetation activities and their success against VMP objectives and performance criteria. – Any recommendations to update or amend the VMP to include alternative or additional activities to meet the objectives and performance criteria of the VMP. 	Annually in Spring	Bush regeneration contractor, weed control contractor, project ecologist
Corrective actions	All zones	<p>To correct any issues identified. Corrective actions may include:</p> <ul style="list-style-type: none"> – Additional weed control events (increased frequency). – Additional weed control strategies (different treatments / techniques). – Additional supplementary planting events or techniques (e.g increased irrigation). 	Performance criteria are achieved as per the management actions detailed above.	<p>Once two or more monitoring events reveal either:</p> <ul style="list-style-type: none"> – An increase in the coverage of exotic species (especially priority weeds) or the introduction of new weeds. – Native vegetation performance criteria have not been met. <p>Restoration targets have not been achieved by Year 5.</p>	<p>Site manager</p> <p>Project ecologist</p> <p>Bush regeneration contractor</p> <p>Weed control contractor</p>

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Appendices

Appendix A

Revegetation species list and densities

Planting densities

Table A.6.1 Planting densities

Zone 4	Trees	Shrubs	Ground covers/ grasses	Total
Density	1 per 5 m ²	1 per 2 m ²	1 per 1 m ²	
Required numbers	4,240	10,600	21,200	36,040

Species list

Table A.6.2 Recommended planting list for veg zone 4 (PCT 1591)

Scientific name	Common name
Trees	
<i>Eucalyptus punctata</i>	Grey Gum
<i>Angophora floribunda</i>	Rough Barked Apple
Shrubs	
<i>Persoonia linearis</i> ;	Narrow-leaved Geebung
<i>Bursaria spinosa</i>	Sweet Bursaria
<i>Acacia parvipinnula</i>	Silver-stemmed Wattle
<i>Leptospermum trinervium</i> ;	Flaky-barked Paperbark
<i>Lissanthe strigosa</i>	Peach Heath
<i>Melaleuca nodosa</i>	Prickly-leaved Paperbark
<i>Leucopogon juniperinus</i> ;	Prickly Beard-heath
<i>Jacksonia scoparia</i> ;	Winged Broom-pea
Ground covers	
<i>Themeda australis</i> ;	Kangaroo Grass
<i>Microlaena stipoides</i>	Weeping Grass
<i>Imperata cylindrica</i> ;	Blady Grass
<i>Panicum simile</i>	Two-colour Panic
<i>Aristida vagans</i>	Threeawn Speargrass
<i>Cheilanthes sieberi</i>	Mulga fern
<i>Pomax umbellata</i> ,	White Root
<i>Lomandra longifolia</i>	Spiny-headed Mat Rush
<i>Entolasia stricta</i>	Wiry Panic
<i>Cymbopogon refractus</i>	Barbwire Grass

Appendix B

Weed control guidelines

Fireweed (*Senecio madagascariensis*)

Long-term fireweed control needs to consider that:

- Most new seedlings appear in autumn
- Many new seedlings appear after rain when temperatures are 15–27°C
- Seedlings grow fast and can flower 6–10 weeks after emerging
- Flowering and seeding occur mostly in spring
- Most plants die off by late spring
- Some plants live for up to three years - the tops die back in spring and regrow the following autumn
- Fireweed seed buried deeper than two centimetres is unlikely to germinate
- Long-term follow up is essential because about 15% of seeds remain dormant for over 10 years

In environmentally sensitive areas it is recommended to hand-pull individual plants and spot spray herbicide where necessary and within the most appropriate time of the year, generally late autumn (DPI, 2021).

Table B.1 Herbicide options for control of Fireweed (DPI, 2021)

Herbicide	Rate	Method
Metsulfuron-methyl 600 g/kg (Various products)	10 g in 100 L of water	Spot spray application
Fluroxypyr 140 g/L + Aminopyralid 10 g/L (Hot Shot™)	500 mL in 100 L of water	Spot spray flowering plants up to 30 cm tall
Picloram 100 g/L + Triclopyr 300 g/L + Aminopyralid 8 g/L (Grazon Extra®)	350 mL in 100 L of water	Spot spray application

Lantana (*Lantana camara*)

To control lantana:

- Gradually control sections of large infestations, starting at the edges (do as much at a time as you can follow up).
- Dry or frosty periods are good times to work on mature lantana plants.
- Treat regrowth or seedlings before they are 1 m high.
- Control young plants before they are a year old to prevent new fruit and seeds.
- In summer, look for a flush of seedlings after rain, and kill the seedlings 1 – 3 after the rain event (lantana seeds can germinate year round but peak after summer rain).
- 1 – 3 months after clearing, burning or cultivation, look for regrowth or new seedlings and control them.
- 3 – 6 months after the end of a dry spell, look for dry lantana that appeared dead reshooting from the base, and control the regrowth
- In spring, look for plants that reshoot after frost damage, and control the survivors.
- Physical removal can occur year round, after rain when soil is moist. Follow-up within 3-6 months.

Chemical control

Spraying leaves

Small plants less than 2 m can be sprayed at any time of the year as long as they are actively growing. Stressed plants don't take up much herbicide. Treat regrowth from burning, cutting, slashing or frost when plants are 30 cm to 1 m high.

Spray mature lantana (>2 m high) between February and the first frost.

Early morning or late afternoon is the best time to spray during Autumn.

Gas or splatter-gun

Splatter-guns use small amounts of highly concentrated herbicide. A five-litre bottle of mixed herbicide should cover about 0.2 hectares of lantana. The splatter gun:

- Works best on dense infestations at least 300 mm high
- Limits off-target plant damage
- Is good for hard-to-access and steep areas
- Can be used year round if plants are actively growing, but works best during summer
- Is cheaper than traditional foliar spray methods

Spray before 10 am and after 3 pm when it's cool. Angle the gun at 45 degrees and spray an arc over the top of the plant and down the front face. Apply 2 squirt lines per half a metre of plant height. The amount to apply will depend on the herbicide concentration. Do not spray until herbicide runs off.

Do not use the splatter-gun:

- In wet weather
- When there is water or dew on the plants
- On spindly lantana regrowth

Spraying stems

Applying herbicide to the stems is called 'basal barking'. It's effective at any time of year. Mix herbicide with diesel. Apply around all stems from the ground up to 30 cm high by:

- Spraying at low-pressure
- Painting on with a brush

Cut stump method

Cut stems off at about 15 cm from the ground. Apply herbicide to the cut surface of the stump within 15 seconds. Treat every cut stem because lantana regrows vigorously from untreated stems.

Herbicide	Rate	Method
2,4-D 300 g/L + Picloram 75 g/L (Tordon® 75-D)	650 mL per 100 L of water	High volume spot spray. Thoroughly wet foliage and soil around the base of plant during March to May.
2,4-D amine 625 g/L (Various products)	320 mL in a 100 L of water	Apply to actively growing bushes
Dichlorprop 600 g/L (Lantana 600®)	1.0 L per 200 L of water	Spot spray application, completely wet all leaves and stems.
Fluroxypyr 140 g/L + Aminopyralid 10 g/L (Hot Shot™)	500 mL per 100 L of water	seedlings and regrowth 0.5–1.2 m height. Apply to actively growing plants.
Fluroxypyr 200 g/L (Comet® 200 herbicide)	500 mL or 1.0 L per 100 L of water	Apply to actively growing bushes from October to April. Use lower rate on seedlings or bushes to 1.2 m high, higher rate on bushes over 1.2 m.
Fluroxypyr 333 g/L (Starane™ Advanced)	300 - 600 mL in 100 L of water	Apply to actively growing bushes from October to April. Use lower rate on seedlings or bushes to 1.2 m high, higher rate on bushes over 1.2 m.
Glyphosate 360 g/L (Various products)	1.0 L per 100 L of water	Actively growing with full foliage. Avoid summer stress.
	1 part per 9 parts water	Gas gun / Splatter gun application. Apply 2 x 2 mL doses per 0.5 m of bush height
Glyphosate 360 g/L with Metsulfuron-methyl 600 g/kg (Various products)	10 g metsulfuron-methyl plus 200 mL glyphosate per 100 L of water	Apply to bushes up to 2 m high. Thoroughly wet all foliage and stems. Add organosilicone penetrant.
Metsulfuron-methyl 300 g/kg + Aminopyralid 375 g/kg (Stinger™)	20 g in 100 L of water	Hand gun application.
Metsulfuron-methyl 600 g/kg (Various products)	10 g per 100 L of water	Apply to bushes up to two metres tall. Spray to wet all foliage and stems. Re-treatment will be necessary.
Picloram 100 g/L + Triclopyr 300 g/L + Aminopyralid 8 g/L (Grazon Extra®)	350 - 500 mL in 100 L of water	Wet thoroughly, use higher rate on large bushes, 1–2 m tall. Low rates for bushes up to 1 m tall. Apply from summer to autumn.
Picloram 44.7 g/kg + Aminopyralid 4.47 g/L (Vigilant II ®)	Undiluted	Cut stump application. Apply a 3–5 mm layer of gel for stems less than 20 mm. Apply 5 mm layer on stems above 20 mm .
Triclopyr 240 g/L + Picloram 120 g/L (Access™)	1.0 L per 60 L of diesel	Basal bark or cut stump application.
Triclopyr 300 g/L + Picloram 100 g/L (Various products)	350 - 500 mL per 100 L of water	Wet thoroughly, use higher rate on large bushes, 1–2 m tall. Low rates for bushes up to 1 m tall. Apply from summer to autumn.
Triclopyr 600 g/L (Garlon® 600)	1.0 L per 60 L of diesel	Basal bark application for basal diameter less than 5 cm or cut stump application above 5 cm.

Appendix C

Example weed control proforma template

Weed control proforma			
Project details			
Date			
Name			
Contact details			
Location			
Company/organisation			
Site	1	2	3
Weather	Wind speed and direction:		
	Temperature:	Rainfall (prev 24hrs):	
Woody weeds			
Weed cover %			
Dominant species			
Proportion ground cover extent			
Weed cover %			
Dominant species			
Native cover %			
Common species			
Treatment			
Weed management techniques used (e.g. Spray unit, manual removal, cut and paint)			
Equipment details (eg nozzle type, angle, pressure)			
Product details (transcript product name, rate or dose from the label)			
Volume of herbicide used	Concentrate: mL Mixed volume: L	Concentrate: mL Mixed volume: L	Concentrate: mL Mixed volume: L

Weed control proforma

Maintenance and additional works required

Photos taken at monitoring locations (circle answer)	Yes / No	Yes / No	Yes / No
Planned work before next monitoring report			
Any recommendations for corrective actions to improve weed management outcomes at the site.			



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